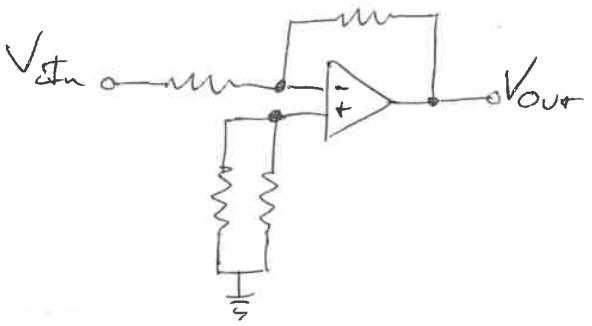
Exercise 4.1

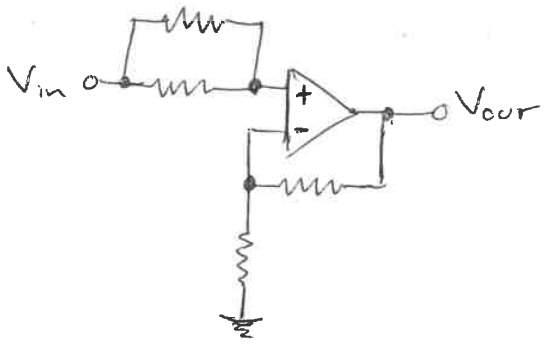
Unity-Gain Inverter; $G_V = -1$



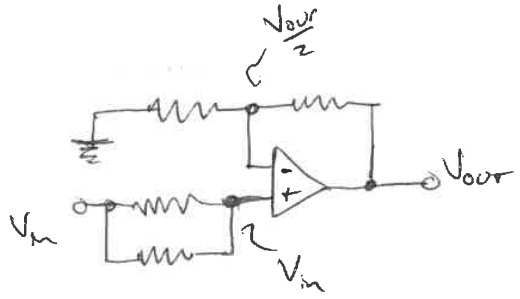
because all R's equal

$$G_V = -\frac{R_f}{R} = -1$$

Non inverting Gain of 2 : $G_V = 2$



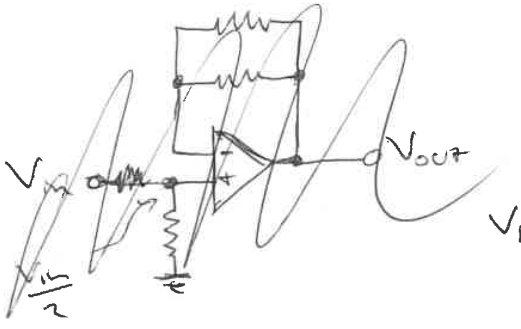
or

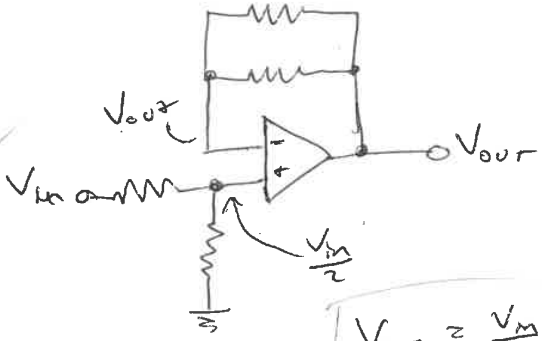


$$\frac{V_{OUT}}{2} = V_{in}$$

$$V_{OUT} = 2V_{in}$$

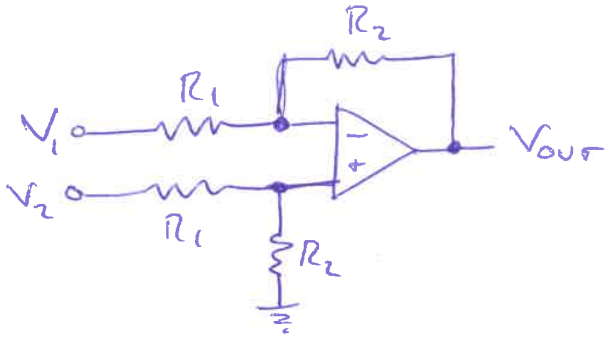
Non inverting gain of 0.5 : $G_V = 0.5$





$$V_{OUT} = \frac{V_{in}}{2}$$

Difference Gain Amplifier [fig 4.9a page 227]



$$V_{OUT} = \frac{R_2}{R_1}(V_2 - V_1)$$

$$V_+ = \frac{R_2}{R_1+R_2} V_2 \qquad V_1 - I R_1 = V_- = V_+ = \frac{R_2}{R_1+R_2} V_2$$

$$V_1 - \frac{R_2}{R_1+R_2} V_2 = I R_1$$

$$I = \frac{V_1}{R_1} - \frac{R_2 V_2}{R_1(R_1+R_2)}$$

$$V_1 - I R_1 - I R_2 = V_{OUT}$$

$$V_{OUT} = V_1 - V_1 + \frac{R_2}{R_1+R_2} V_2 - \frac{R_2}{R_1} V_1 + \frac{R_2^2 V_2}{R_1(R_1+R_2)}$$

$$= \frac{R_1 R_2 V_2}{R_1(R_1+R_2)} - \frac{R_2(R_1+R_2)V_1}{R_1(R_1+R_2)} + \frac{R_2^2 V_2}{R_1(R_1+R_2)}$$

$$= \frac{R_1 R_2 V_2 - R_1 R_2 V_1 - R_2^2 V_1 + R_2^2 V_2}{R_1(R_1+R_2)}$$

$$= \frac{R_2 V_2 (R_1+R_2) - R_2 V_1 (R_1+R_2)}{R_1(R_1+R_2)}$$

$$V_{OUT} = \frac{R_2}{R_1}(V_2 - V_1)$$